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ABSTRACT

Originally designed for gifted students, these reproducible ecology units emphasize the use of higher order thinking skills and are appropriate for use in any classroom. Interdisciplinary in content, the units provide a broad view of ecology. Included are two complete units, one created for the upper elementary gifted student and the other for the lower elementary gifted student. Suggestions for adapting the materials to fit other classrooms are included. Several learning modalities are designed into the materials to encourage active student participation. (CW)

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Zephyr Learning Packets

ECOLOGY

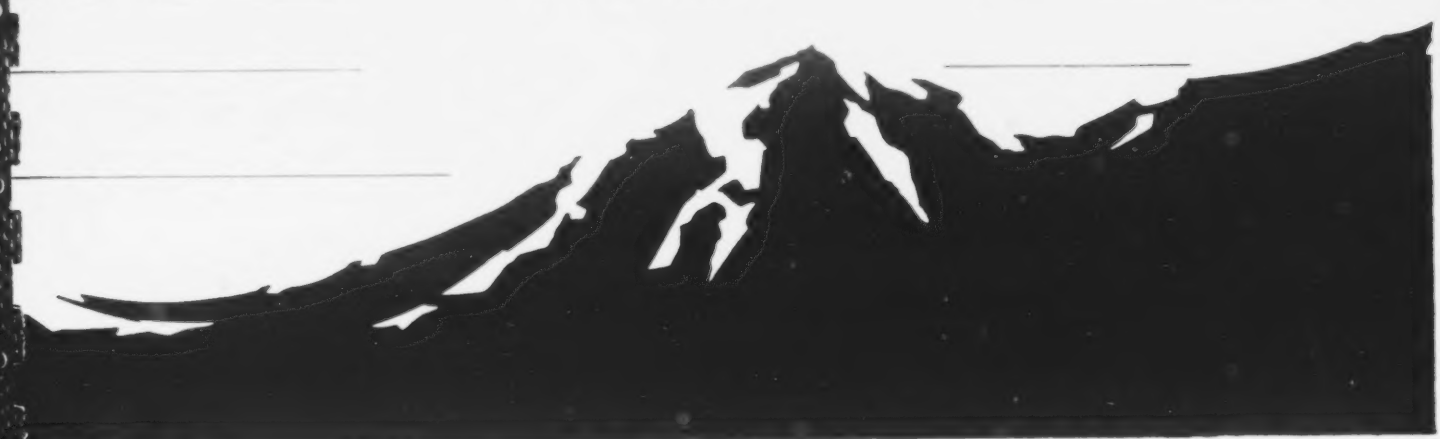
A SELF-DIRECTED LEARNING EXPERIENCE
Interdisciplinary – Product Oriented
Grades K – 8

SE 051 154

Zephyr Learning Packet

The Study of Ecology

Learning to Love Our Planet



ECOLOGY:

Self-Directed Study Units for grades K-3 and 4-8, gifted easily adapted for regular classroom use

Interdisciplinary and
Product Oriented
through the use of:

- Evaluating
- Classifying
- Comparing
- Imagining
- Researching
- Mapping & Charting
- Creating
- Reporting
- Thinking...Reacting
- Career Exploration

ZEPHYR PRESS
TUCSON, ARIZONA

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Researched and Compiled by
Judith Enz and Susan Diffenderfer
Edited by
Joey Tanner

ISBN 0-913705-01-2

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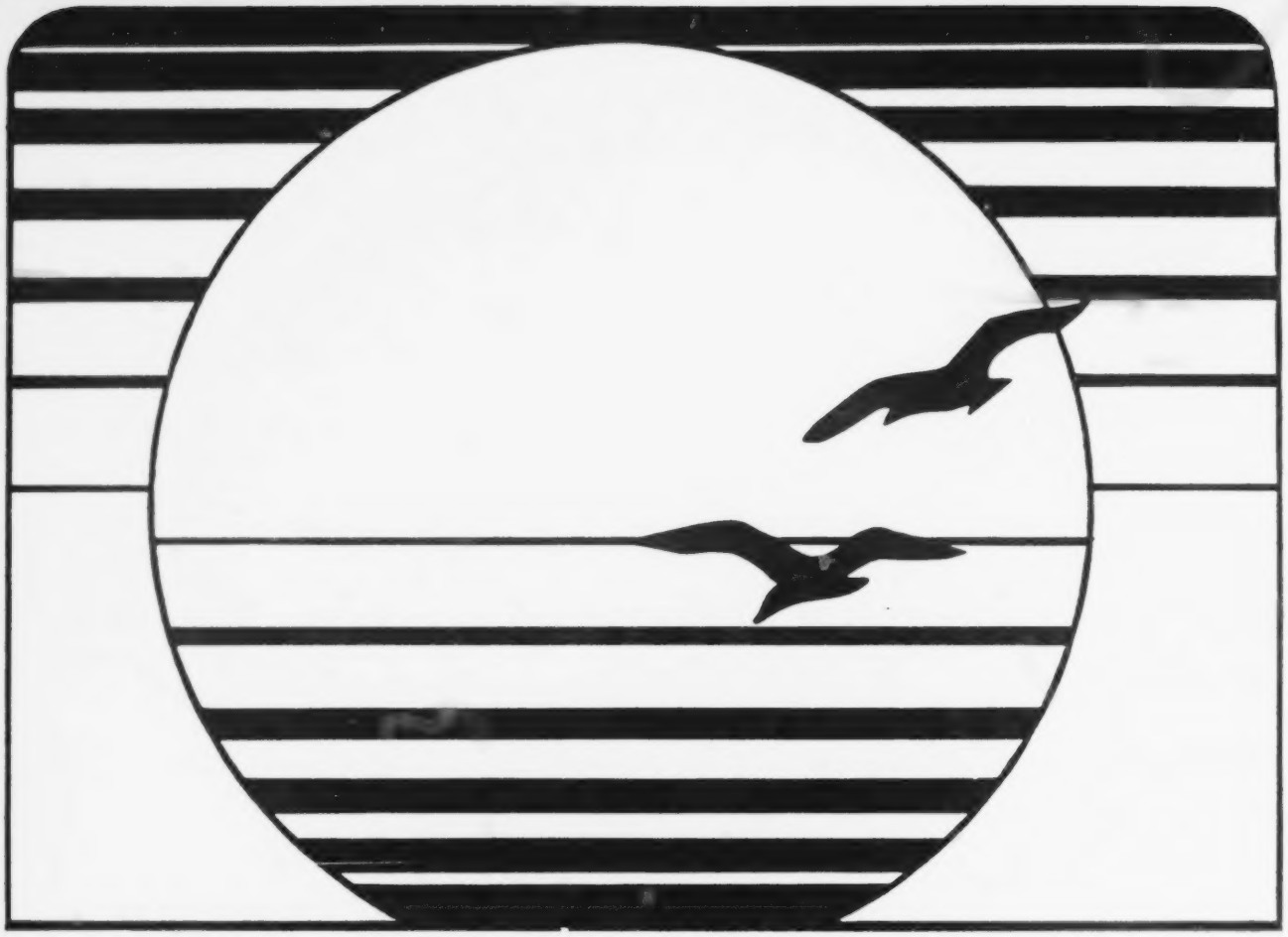

"All things are connected.
Whatever befalls the earth,
befalls the sons of the earth.
Man did not weave the web of life.
He is merely a strand in it.
Whatever he does to the web,
he does to himself."

Chief Noah Seattle, 1954

ZEPHYR PRESS, TUCSON ARIZONA

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THE PREMISE

CHILDREN ARE ACTIVE PARTICIPANTS IN THEIR LEARNING, NOT PASSIVE VESSELS TO BE FILLED. THEY ARE ALWAYS SEEKING AND CHOOSING WHAT THEY WILL LEARN AND WHAT THEY WILL NOT LEARN. THEIR ACTIVE INVOLVEMENT IS CRUCIAL TO LEARNING. CHILDREN TEND TO BECOME PERSONALLY INVOLVED IN PROJECTS THAT APPEAL TO A VARIETY OF MODALITIES . . . READING, WRITING, BUILDING, CREATING, IMAGINING, AND REAL THINKING . . . SO A VARIETY OF EACH IS INCLUDED IN THIS SELF—DIRECTED LEARNING UNIT.

A WORD TO THE TEACHER

The study of ECOLOGY — Learning to Love Our Planet

Come along on an ecological journey . . . a journey that will lead you through beauty, awe, humility, and fear. Ultimately, you will grow into a kinship with the vast and largely unseen community with whom you share this earth.

The first step begins with AWARENESS . . . the developing of a keen eye and sensitivity to your surroundings, both living and non-living. From awareness springs CURIOSITY about those things that share this time and place with us . . . and about their effect on us and ours on them. Curiosity leads to EXPLORATION and EXPERIMENTATION, and from these things grows UNDERSTANDING and PERSPECTIVE.

The journey does not stop there. The ecological traveler, knowledgeable about the environment and its many fragile networks, comes to feel CONCERN and a sense of RESPONSIBILITY for its care. A nation and world of such people has little to fear.

On the most private, individual level such a journey has rich rewards. It lessens our sense of estrangement from the natural order which modern life seems to engender. It restores to us a feeling of CONNECTEDNESS . . . of belonging to the wide, yet initimate, fellowship of life that swirls around us. *Above all, there gradually grows from deep within each traveler, a sense of WONDER and AFFECTION for it all.*

It is hoped that through the pages of this packet, young persons may set out upon that journey for themselves.

"ONE CAN LEARN THE CAMPAIGNS OF THE CIVIL WAR WITH DATES, BATTLES AND CHARACTERS WITHOUT LEARNING ANYTHING ABOUT WHY WARS ARE FOUGHT BETWEEN FRIENDS OR WHAT IDEAS CAN BE GENERALIZED TO OTHER CONFLICT SITUATIONS."

James Gallagher,
Teaching the Gifted Child, 1974

RATIONALE FOR SELF-DIRECTED LEARNING

Our children's education must be more than the memorization of capitols of the states, the products of countries and the dates and places of past wars. Most teachers and parents would agree that what is also wanted is for children to learn to think for themselves, to organize their own time, to make wise choices, to work independently and to thoughtfully evaluate the results of their study.

OBSTACLES TO INDEPENDENT LEARNING

In spite of the teacher's best efforts, many, if not most, classroom settings are organized in such a way that students are involved in schedules and organizational plans that foster dependence rather than the independence we prefer. Students are told what is to be learned, how long it will take them to learn it, the resources are defined by the teacher and, afterwards, the teacher rather than the student decides whether the learning experience was a satisfactory and valuable one.

A LEARNING ATMOSPHERE

Each time we, as educators, focus on what our objectives are, we need to take a fresh look at our classroom mode of operation and evaluate the effectiveness of the way we teach. Quite naturally, for most of us, our teaching style has more to do with how we were taught than with what recent research has shown about the learning process. Even our good instincts have been overcome by the years of conditioning we have known in our own educational experiences.

Like a breath of fresh air, the recent findings coming from the research on the brain and how it operates are supporting our intuitive knowledge. This research is showing that our brains are receptive to learning only under certain conditions. Our job is to translate that information into a classroom atmosphere that provides:

- challenge
- freedom within structure
- trust and warmth
- opportunities to experience success
- personal involvement in the curricula

A natural transition generally occurs that transforms the former "teacher-lecturer" into a "fellow-learner". As a "fellow-learner" the teacher's role becomes one of a resource person, a facilitator and a classroom manager. In this maturing atmosphere, students gradually come to see themselves as responsible for their own learning and a foundation for self-direction is set.

• • •

At this point, a sometimes unexpected problem arises. We find the student no more ready for their independent learning than we, as teachers, were ready to allow it. This common occurrence is mentioned repeatedly in the literature dealing with programming for the gifted, an area where independent study and research are recommended as a major curricular activity (see **Suggested Reading List**; Maker (1982), Doherty & Evans (1980), and Feldhusen and Treffinger (1980).

FROM PASSIVE LEARNER TO ACTIVE PARTICIPANT (BRIDGING THE GAP)

The **ZEPHYR** self-directed study unit was developed expressly to bridge that gap . . . to transport the student from the position of passive recipient to that of an active participant in his/her own pursuit of knowledge.

Within the defined structure of each unit, the students are given opportunities to:

- make choices
- learn at their own pace
- learn in a manner more closely suited to their own learning style
- expand research skills
- use a variety of modalities
- plan their own time
- develop the skills of creative, critical and evaluative thinking
- experience whole-brain learning

Since responsibility for directing their own learning is so often an unfamiliar situation, the students will need your encouragement at the start. Generally, within six to nine weeks, most students will be well on their way from teacher dependence to self-motivation. (Beginning the venture with only a few choices, then gradually arranging the setting so that there are more and more choices, works best.) As students assume more responsibility, many teachers begin to consider the school library as just another part of the classroom . . . the benefits are many . . . from gaining a personal relationship with the librarian to learning about the enormous resources available, but often unused, in most school libraries.

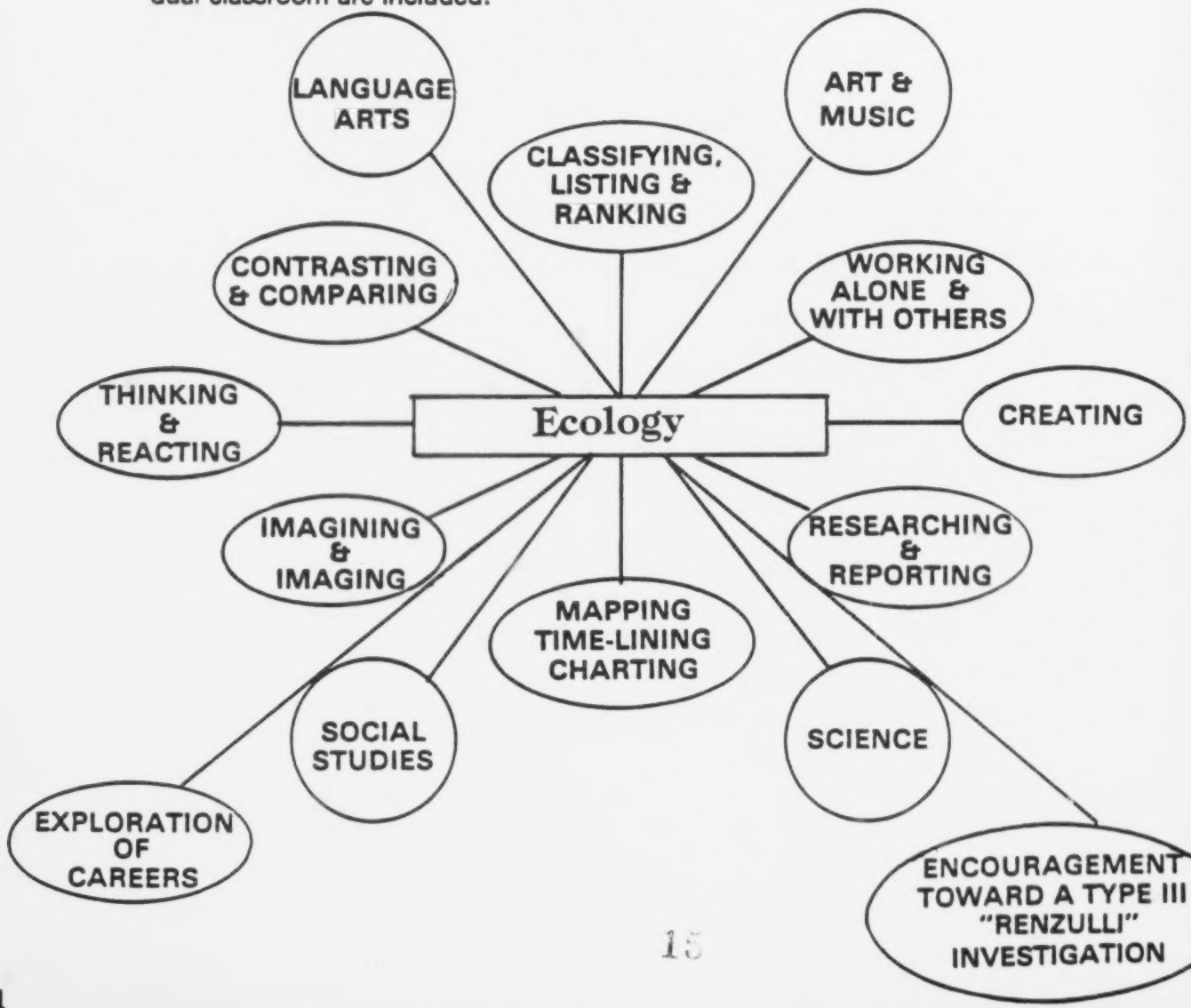
Eventually, a few students will be ready for a true investigative research study of professional quality as suggested by Joseph Renzulli in **The Enrichment Triad Model, A Guide for Developing Programs for the Gifted and Talented**, 1977.

THE FORMAT

Originally developed for the gifted student, these units emphasize the use of the higher level thinking skills . . . and are appropriate for use in any classroom where the goal is to encourage students to become responsible for their own education.

Interdisciplinary in content, the unit envelopes a broad view of the topic by integrating the "basics" into each activity.

Within this book are two complete units, one created for the upper elementary gifted student and the other for the lower elementary gifted student. Suggestions for adaptations for adjusting either of the levels to fit any individual classroom are included.



SUGGESTED READINGS

SELF-DIRECTED STUDY

"Bells, Groups and Independent Study", **Psychology and Education of the Gifted.** Barbe, W. and Renzulli, J. New York, 1975. Irvington Publishers.

Creative Questioning and Sensitive Listening Techniques. Carin, A. and Sund, R. Columbus, Ohio, 1978. Charles Merrill Publishing Company.

Creative Thinking and Problem Solving in Gifted Education. Feldhusen and Treffinger. Dubuque, Iowa, 1980. Kendall-Hunt Publishing.

Curriculum Development for the Gifted. Maker, C.J. Rockville, Maryland, 1982. Aspen Systems Corporation.

Enrichment Triad Model: A Guide for Developing Defensible Programs for the Gifted and Talented. Renzulli, J. Mansfield, Connecticut, 1977. Creative Learning Press.

Growing Up Gifted. Clark, B. Columbus, Ohio, 1978. Charles Merrill Publishing Company.

Open to Change: Options for Teaching Self-Directed Learners. Malehorn, H. Palo Alto, California, 1978. Scott Foresman Company.

Self Concept and School Achievement. Purkey. Englewood Cliffs, N.J., 1970. Prentice-Hall, Inc.

Self Starter Kit for Independent Learning. Doherty and Evans. Austin, Texas, 1980. Special Education Associates.

Teaching the Gifted Child. Gallagher, J. Boston, Massachusetts, 1975. Allyn and Bacon

INTEREST DEVELOPMENT CENTER
ECOLOGY

THE PURPOSE OF THE INTEREST DEVELOPMENT CENTER IS TO STIMULATE INTEREST IN THE TOPIC AREA. THE STUDENT NEEDS TIME FOR BROWSING AND INVESTIGATION FOR MAXIMUM BENEFIT.

(Beginning ideas . . . you and your students will think of more . . . let parents and other teachers know about the Center and it will many times grow without effort.)

BOOKS, POSTERS, MAGAZINES, FILMSTRIPS, CHARTS about:

Plant and animal adaptation
Symbiosis
Conservation
- endangered and other species
- natural resources
- wilderness areas, beaches

Life in various ecosystems
Energy use and conservation
Environmental awareness
Environmental issues, concerns
Food chains
Pollution: land, air, water
- industrial chemicals
- pesticides
- fertilizers
- organic wastes

Population
City ecology and urban life
Careers

LOCAL SPEAKERS

Officials from utilities, city planning, water departments
Environmental activists
Conservation groups
Nature museum representatives
Ecologists (geographers, biologists, urban planners, hydrologists, etc.)

MAPS

Local geographical/physical
Aerial photo of community (old and new)
U.S. maps of the states
Bus and bicycle path maps

RECORDS, TAPES

Nature songs
Environmental sounds
Sounds of whales, dolphins, wolves, bird calls
Traditional music inspired by environment
Grand Canyon Suite (Grofe); La Mer (Debussy); American in Paris (Gershwin); etc.

ARTIFACTS FOR INVESTIGATIONS AND EXPERIMENTS

Nature items: shells, seeds, mold, fungi, small animals, insects
Jars, Aquarium, Screened boxes
Thermometer, Light meter
Microscope, Magnifying glass, Binoculars
Tape recorder
Collecting bags (paper)
Solar cell
Local newspapers
Field guide to local plants and animals
Newsletters of environmental organizations
Bird call whistles

I HEAR ..... AND I FORGET
I SEE ..... AND I REMEMBER
I DO ..... AND I UNDERSTAND
(source unknown)

GETTING STARTED

Select a topic as an extension of a regular curricular subject (particularly when your class seems to crave more) . . . or . . . select a topic to pursue that is of particular interest and may not be part of the curricula. To zero in on special interests, administer an interest survey to each student.

2. Copy the unit for each student. When using these units for the entire class you may want to expand or delete activities for individual students.

3. Set up a center in the classroom that encourages exploration in the subject field. You'll want to include a wide variety of materials. Be creative, the purpose of the center is to excite the student in this subject area so begin with lots of "hands on" materials . . . . allow for ample browsing time and encourage the student to investigate and become absorbed . . . . at the level of a true professional.

With the students, go over each activity in the unit, discussing and answering any questions. The teacher is an integral key in successful implementation. Because most children are already versed in the "One Right Answer Game", they will need encouragement to branch out into many of the open-ended activities in the packets.

5. **Set the stage . . . plan to conference as needed . . . . provide resources as needed . . . .** then **get out of the way** and let your students learn.

6. **Give as much time** as each student needs to complete each activity in the unit. The entire packet might take from five to ten weeks or longer.

7. As each activity is completed and evaluated, **initial the symbol** located near each activity number. You will want to **evaluate** on the basis of what response is appropriate for **that student.**

8. When a student shows an extreme interest in the topic, the completion of this unit might be only the beginning. This student may well be ready for further study and research and **needs** only the **resources, guidance and freedom** to pursue his/her well-planned project.

In preparation for further research, the student will need to decide:

WHAT WILL THE STUDY BE? (what will be investigated and produced)

WHERE WILL BACKGROUND INFORMATION BE FOUND? (i.e., speakers, interviews, books, films, microfiche, documents, etc.)

WHAT, EXACTLY, WILL BE THE FORM OF THE PRODUCT? (a model, a manuscript, or . . .)

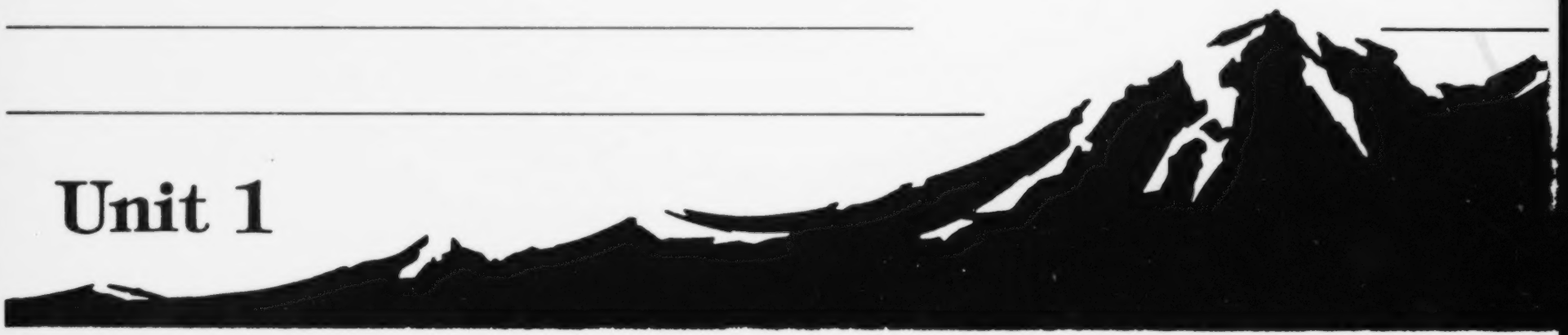
WHO MIGHT BE INTERESTED IN THE PRODUCT? (professionals in the field, publishers, organizations, etc.)

WHAT IS NEEDED TO BEGIN? (specific plans, resources, deadlines . .)

AGAIN . . . STEP BACK . . . PROVIDE GUIDANCE . . .
and LET HIM/HER GO!

The Study of Ecology

Learning to Love Our Planet



Unit 1

Name _____

Date _____

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Setting The Stage . . .

LOOK AROUND YOU.

Look at the people, at the chairs, the books, the papers . . .

Imagine the tiny things you can't see . . . the bits of dust . . . the insects within the walls . . . the bacteria.

Now go to the window. Look out as far as you can see . . . at the buildings . . . the trees . . . the cars . . . the birds.

IN YOUR MIND, LOOK BEYOND WHAT YOU CAN SEE HERE . . .

Look far beyond to the countryside, with its forests and farms and lakes . . . to the ocean, with its fish and whales and microscopic sea life.

Imagine other lands . . . other peoples . . . climates . . . insects . . . animals . . . all busy with their own lives at this very moment . . . as you are.

You may feel alone, but you are part of a large community of living things. You need that community to live . . . and it needs you.

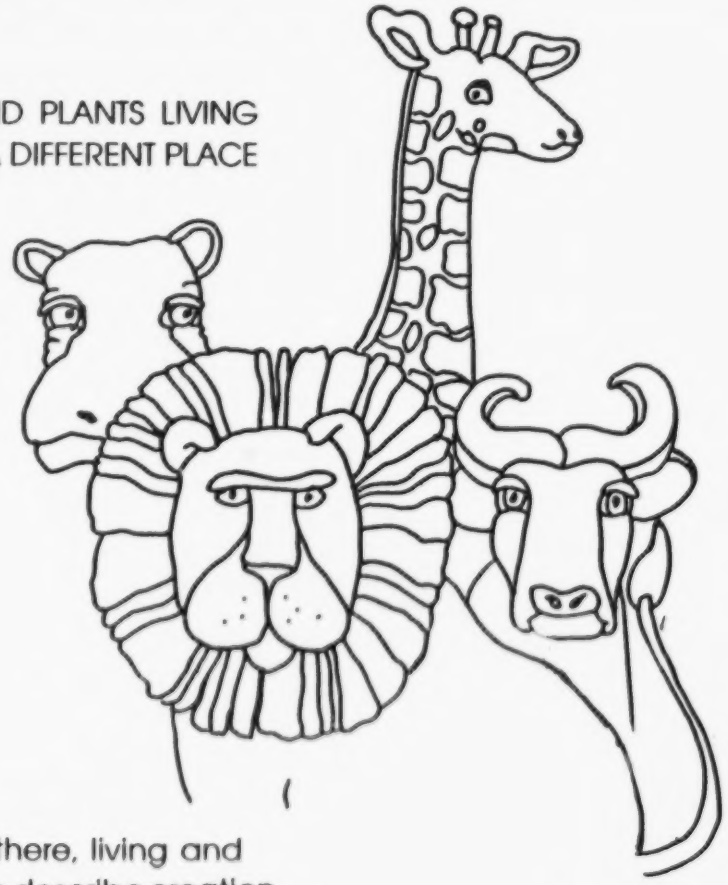
TOGETHER WE SHARE THIS EARTH . . . THIS DAY . . . AND TOMORROW . . .

IT'S TIME WE BECAME ACQUAINTED.

2

1. Ecosystems / Vocabulary

AT ANY ONE PLACE ON EARTH, YOU WILL FIND CERTAIN ANIMALS AND PLANTS LIVING TOGETHER IN A HARMONIOUS WAY. THEY ARE AT HOME THERE. LOOK AT A DIFFERENT PLACE AND YOU WILL FIND A DIFFERENT COLLECTION.



MAKE several lists of plants and animals that live together harmoniously.

As you learn about Ecology, you will get to know these words well:

ECOSYSTEM
BIOME
BIOTIC
COMMUNITY
PHYSICAL
ENVIRONMENT
HABITAT

- **CHOOSE** one **BIOME** and **LIST** the things you would expect to find there, living and non—living. **CREATE** a mural or diorama of the biome. **USE** the word list to describe creation.

2. Ecosystems / Awareness

FIRST . . .

Listen to some songs about nature and its creatures. Try, "Spin, Spider, Spin", an album of nature songs.

THEN . . .

- **PRETEND** you have become any animal. **THINK** about your life.
  What kind of biome do you live in? What shares it with you?
  What do you eat? What does your skin feel like? What should you be careful about?
  What do you do in the rain?

  DRAW a picture of your animal home. Maybe from the inside . . . or maybe from your doorway, looking out at your neighborhood.
  OR
  WRITE a story about your life as an animal.

— OR —

- **DISCOVER** the coastline ecosystem. Try to find:

  See Along the Shore by Millicent E. Selsam
  The Beachcomber's Book by Bernice Kohn
  Along the Seashore by Margaret Waring Buck

> **"Walking on the beach looking for perfect shells I almost did not see the intricate patterns and broken beauty of the fragments."**
> **Sam Keen**

TAKE or IMAGINE an observer's walk. Go slowly, watch with keen eyes. On the way back notice things you missed the first time.

COLLECT samples of the biotic community (shells, beach plants, feathers . . .)
CREATE a collage. (Sandpaper might make a good background.)
(If your walk was imaginary, "collect" the samples from a magazine.)

3. Ecosystems: The Wet and The Dry

- **READ** ABOUT THE SEA

  The Bottom of the Sea by Augusta Goldin
  The Coral Reef: What Lives There by Gilda Berger
  From Shore to Ocean Floor by Seymour Simon

  PRETEND you are one of the creatures you have read about.

  WRITE an illustrated story or a poem or song about your life beneath the sea.

  Include pictures of some of the other creatures you live with.

— **OR** —

- **READ** ABOUT DRY PLACES

  Desert Voices by Byrd Baylor
  We Walk in Sandy Places by Byrd Baylor
  Creatures and Features of the Desert by Rita H. Dickinson
  The Desert is Theirs by Byrd Baylor
  The Gentle Desert by Laurence Pringle
  Along Sandy Trails by Ann Nolan Clark

  CREATE a diorama or mural to show an interesting dry place.

TAKE A LOOK UNDER THE SEA

"They that go down to the sea in ships . . . these see the works of the Lord, and his wonders in the deep."

Psalm 107:23-24

---

4. Ecosystems: More Words

"Jack Sprat could eat no fat
His wife could eat no lean
And so betwixt them both, you see,
They licked the platter clean."
Nursery Rhyme

IMAGINE what would happen if all creatures ate the same thing.

WORDS YOU SHOULD KNOW:

FOOD CHAIN
PRODUCERS
CONSUMERS
DECOMPOSERS
PREDATORS
SOLAR
FUNGI
SCAVENGERS
CONVERSION OF ENERGY

- **MAKE** a picture showing at least 5 things in a food chain. Show what eats what. (Will your pictures be in a straight line or in a circle?)

5. Ecosystems: Photosynthesis

PLANTS CAN MAKE THEIR OWN FOOD. HOW DO THEY DO IT?

- **READ** about photosynthesis. **LEARN** these words:

CHLOROPHYLL	GLUCOSE
OXYGEN	CYCLE
CARBON DIOXIDE	SOLAR ENERGY

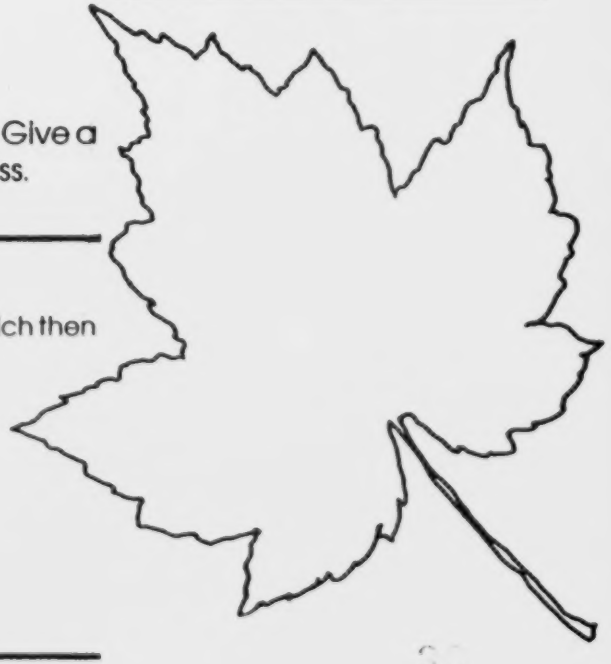
Then **CHOOSE** a plant that you like. **DRAW** its picture on a large sheet of paper. **SHOW** how it produces food energy and gives us oxygen to breathe.

— OR —

- **FIND OUT** about 4 different kinds of food that plants can make within themselves. Give a talk to your class about food producers. Show examples of those four to the class.

Ms. Greenleaf's Recipe for Plant Energy

1.
2.
3.
4.



Next time you notice a plant, think about how busy it is. Tell it, "Thank you!"

Dead things are important, too. Their stored body energy feeds many tiny, hungry organisms which then create new soils . . . to grow new plants.

Good books to read:
Our Tiny Servants: Molds and Yeasts by Bernice Kohn
From Food to Fertilizer: The Role of Excrement in the Life Cycle by Charles Clay Dahlberg
Life and Death by Herbert Zim and Sonia Blecker
The Dead Tree by Alvin Tresselt
Dead Bird by Margaret Wise Brown

Next time you see a dead plant or animal, tell it, "Thank you," too (but leave it alone).

---

6. Ecosystems: The Sun

FIND OUT about the Earth's important star, the sun, by reading:

Energy From the Sun by Melvin Berger

OR

Dining on a Sunbeam by Phyllis S. Busch

- Many primitive peoples have appreciated the sun more than we do. Some have thought of the sun as God . . . as "Giver of Life". **FIND OUT** about this.

  READ some Native American poetry, or read about other cultures in **A Way to Start the Day** by Byrd Baylor.

  WRITE your own poem to the sun.

— **OR** —

- We can get electricity to run our machines from the sunlight. See what you can **FIND OUT** about solar energy. Share what you learned with your class. Try to find a solar cell to show.

  A reading source: **Sun Power** by Norman F. Smith

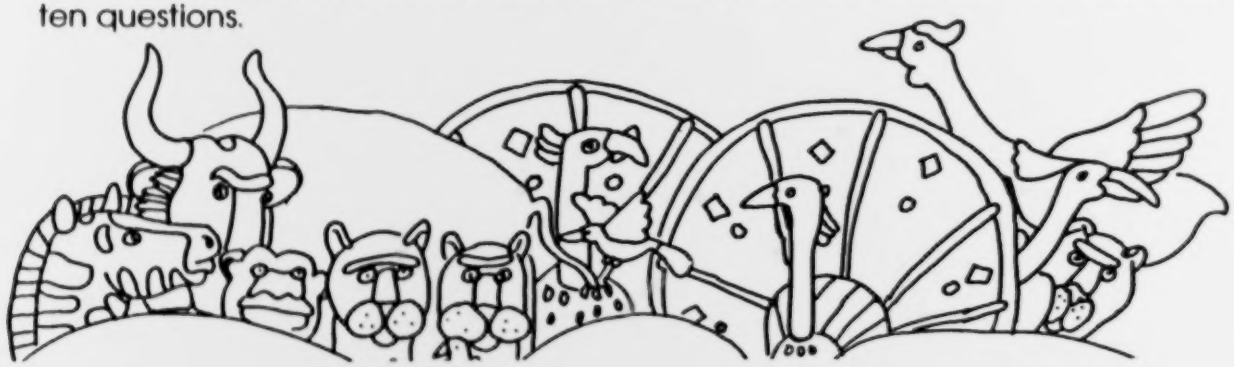
7. Ecosystems: Symbiosis

LEARN ABOUT SYMBIOSIS.

These books will help you.

Symbiosis: A Book of Unusual Friendships by Jose Aruego
Living Together in Nature by Jane E. Hartman
Hidden Animals by Millicent E. Selsam
Anywhere in the World: The Story of Plant and Animal Adaptation by Irma E. Webber
A Place to Live by Jeanne Bendick

- **CREATE** an imaginary interview with an animal you learned about. Prepare at least ten questions.



8. Adaptation

FIND OUT ABOUT ADAPTATION. Ask your librarian for help.

- **CREATE** a picture book showing how bodies of certain creatures have adapted. Be sure to **COMPARE**:

  bird feet
  wings
  beaks
  eyes

  animal feet
  teeth

  the front limbs of different animals and insects

  At the end of the book invent an imaginary "adapted" creature. (Explain how it has adapted itself.)

9. Populations

WHAT is the population of your class right now? _____

What is the population of your school? _____

How many children? _____

Teachers? _____

Others? _____

What is the population of your community? _____

What is the population of your state? _____

WHY are some people concerned about world population?

WHAT is the "population explosion"?

SHOW the population of your own family by preparing a **Family Tree**. Include your parents, grandparents, aunts, uncles, cousins, nieces, nephews . . . as many family members as you can find.

10. Pollution: Trash

INVESTIGATE the problem of solid waste (garbage).

Too Much Garbage by Patricia Lambar

What Happens to Garbage? by Rona Beame

Let's Go to a Recycling Center by Michael Chester
About Garbage and Stuff by Anne Zane Shanks

Dear Garbage Man by Gene Zion

I Love Old Clothes by Mary Ann Hoberman

Notice your family's throw-away habits. **MAKE** a list of ways the "throw-aways" could be re-used.

11. Pollution: Water

"Who hears the fishes when they cry?"
Henry David Thoreau

READ ABOUT WATER POLLUTION.

Our Dirty Water by Sarah M. Elliott.
A Sea of Troubles by J.J. McCoy
The Town That Launders Its Water
by Leonard A. Stevens
Easy Experiments with Water Pollution
by Harry Sootin

Three Drops of Water by Sigmund Kalina
At Last to the Ocean by Joel Rothman
The Water We Drink by Enid Bloome

CREATE a mural explaining the water cycle. Show the places where it can become polluted.
INVENT a way to stop the pollution.

Next time you have a drink of water . . . think of all the living things around the world and way back into ancient times who have shared that water with you. Think about the water your grandchildren will drink. Will it be healthful?

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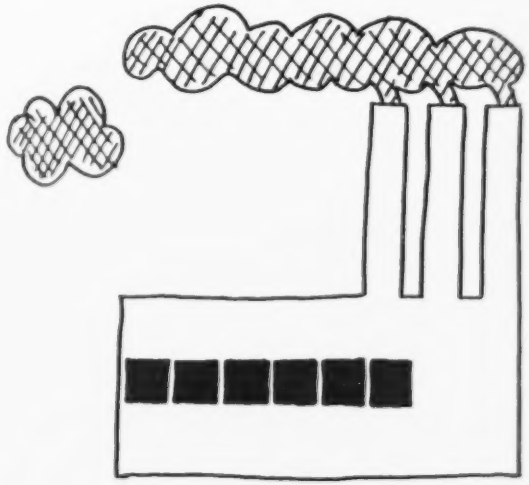
12. Pollution: Air



RESEARCH OUR DIRTY AIR.

Who Will Clean the Air? by Thomas B. Perera

The Air We Breathe by Enid Bloome

FIND OUT what causes polluted air around your community. Prepare a poster to show what people can do to make our air cleaner. (Use your "wildest", most creative ideas.)

13. Pollution: Noise

SOUND HAS **FORCE**.

DISCOVER its vibrations. Feel a guitar or piano as it is being played. Touch a vibrating wire. Touch your stereo speakers.

LEARN ABOUT how your ears work. Send for "Noise and You" from Channing L. Beter, Inc., South Deerfield, MA 01373.

NOTICE how your body reacts to different sounds.

READ: **High Sounds, Low Sounds** by Franklyn M. Branley
First Book of Sound by David C. Knight
The Listening Walk by Paul Showers
The Other Way to Listen by Byrd Baylor
City Rhythms by Ann Grifalconi

THEN . . .

WRITE a poem about sounds.

— OR —

GIVE A DEMONSTRATION to your class about different sounds and vibrations. Which are alike and which are different?

Just for fun . . .

Find a place in your neighborhood where you can hear sounds that are pleasing to you. Perhaps it is best at a certain time of day. Tape record them. Collect them over several days. Play it for yourself later . . . maybe when you are studying or just before you go to sleep.

---

14. Word Fun

WITH A FRIEND, **STUDY** A SPECIFIC ENVIRONMENTAL TOPIC, e.g. water pollution or desert ecosystems. Share the same books.

- **ORGANIZE** a Hangman Tournament.
  Each person makes a secret list of 10 vocabulary words with their definitions. A player gets 10 points for guessing the word and 5 more points for knowing the definition.
  (pssst . . . . try "eutrophication"!)

— OR —

- **MAKE** a crossword puzzle for each other to solve.

— OR —

- **CREATE** "Word Search" games for each other, using definitions as a guide. For example, if you were studying microscopic ocean life,

  a. one-celled plant with a silica cell

  b. tiny drifting plants and animals that float with the current

B	J	D	P	Q	M	J	H
L	G	I	F	I	U	W	A
P	L	A	N	K	T	O	N
F	O	T	A	W	P	L	E
D	R	O	L	P	O	E	P
K	P	M	R	E	D	C	P

15. Ecology: Attitudes

WHEN PEOPLE LIVE CLOSE TO THE NATURAL WORLD, SOMETIMES THE WILD CREATURES AND PLANTS ARE MORE LIKE FAMILY, THAN STRANGERS.

LEARN something about the feelings of Native Americans (or other primitive peoples) toward nature. Some reading ideas:

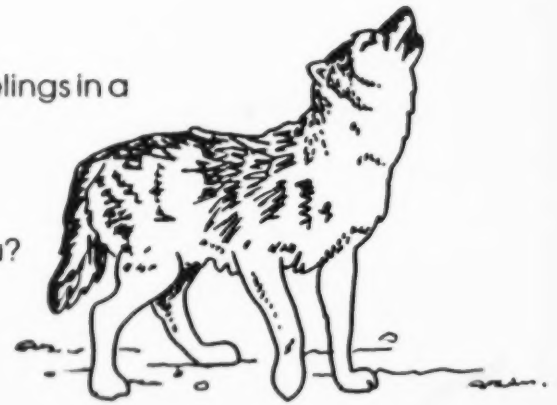
The Desert Is Theirs by Byrd Baylor
Hawk, I'm Your Brother by Byrd Baylor
Coyote Cries by Byrd Baylor
Beyond the High Hills: A Book of Eskimo Poems by Knud Rasmussen

What can we learn from them?

- **PRETEND** you grew up in such a world and then moved to a city. Express your feelings in a story, poem or song.

— OR —

- Is there any animal or plant (a tree, maybe?) in your life that is special to you? **TELL** about it in a story . . . or **WRITE** a letter and tell it how you feel.

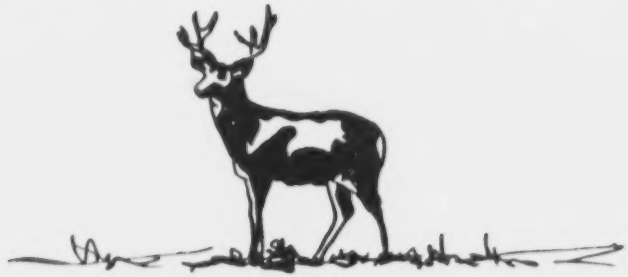


16. Understanding the Issues

LOCATE ONE OF THE FOLLOWING GROUPS and ask a member to speak to your class:

Sierra Club
Audubon Society
Friends of the Earth
Zero Population Growth
Fish and Wildlife Service
Air Quality Control
City Planning Department

Have at least five good questions ready to ask. Be sure there is time for your classmates to ask questions also.



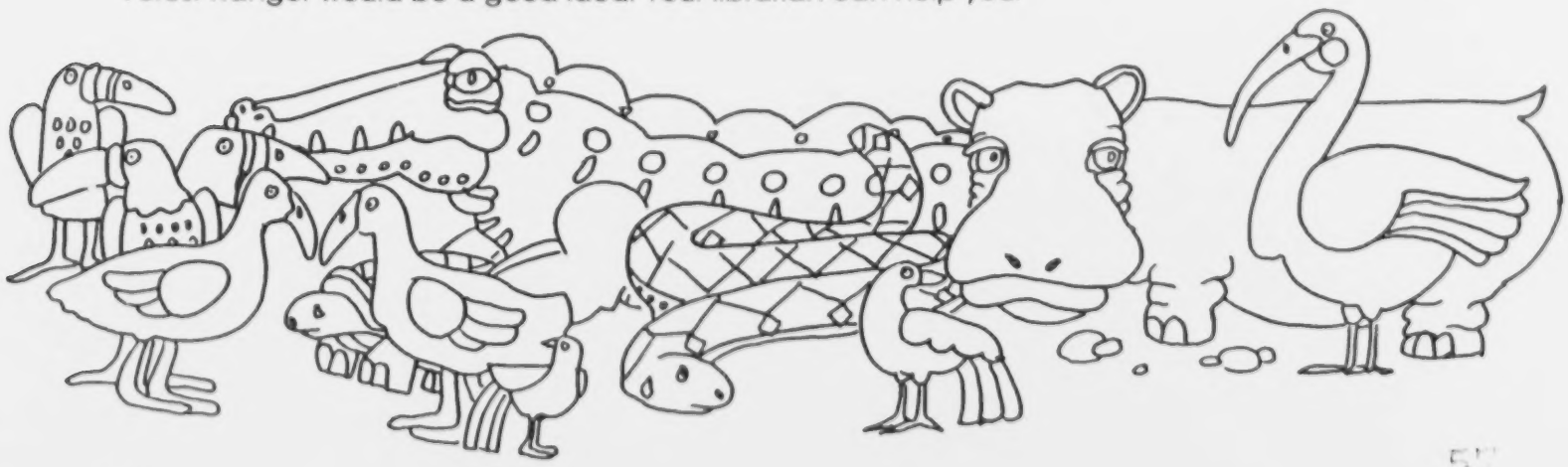
17. Endangered Species

ORGANIZE AN EXHIBIT that tells about at least 5 endangered species. Include:

Books	Posters
Filmstrips	Charts
Pictures	News Articles

Audio tapes of songs about or sounds of animals

INVITE someone to talk to your class about endangered species. A member of the Sierra Club or a Forest Ranger would be a good idea. Your librarian can help you.



SUGGESTIONS FOR ADAPTING THE UNIT TO YOUR PARTICULAR TEACHING-LEARNING SITUATION

1. Require fewer, or more, research sources.

2. Assign more of the activities to small groups instead of to individual students.

3. Give fewer or more choices.

4. Delete some activities altogether.

5. Arrange the unit to be a class project with students choosing different parts to complete.

6. Add some activities of your own.

The Study of Ecology

Learning to Love Our Planet

Unit 2

Name _____

Date _____

Reproduction of these materials for a school district is strictly prohibited. Reproduction by a teacher for use within a classroom is encouraged.

Setting the Stage . . .

IMAGINE that you have just been beamed down to earth from another planet. Your mission is to explore the Earth's life forms. With your tape recorder (your communication with your spaceship) visit an area near your home or school.

Move slowly, sit quietly, watch closely. **DESCRIBE** every sign of life you see or hear . . . the insect by the rock, the bird that flew by. **RECORD** possible signs of previous life (a footprint, a bird dropping, a gum wrapper).

Look with "fresh eyes". Pretend you know nothing about what you are describing. Speak into the tape recorder softly. Try not to disturb what is there. (You might want to draw some sketches of what you see or photograph some of your "strange" sightings.)

ORGANIZE an exhibit of posters, books, filmstrips, etc. showing the beauty and wonder of planet Earth. Include your tape and a cassette player.

For some good ideas, read:

Reading the Landscape by May T. Watts
All Upon a Sidewalk by Jean George
Exploring as You Walk in the City by Phyllis S. Busch

> "In this 20th century, to stop rushing around, to sit quietly on the grass, to switch off the world, and come back to the earth, to allow the eye to see a willow, a bush, a cloud, a leaf, is an unforgettable experience."
> Frederick Franck, **The Zen of Seeing**

1. Familiarize Yourself . . .

EACH WEEK FOR 3 WEEKS - Read 2 articles about the environment and write a summary of each one. State the main idea and supporting points of each article. State whether or not you feel the article is based on fact.

Be sure to note the following: Author and title of article, title of magazine or newspaper, date of publication, page numbers of article.

Example: Earle, Sylvia A., Ph.D., "The Gentle Giants", National Geographic (January, 1979), pp. 2-17.

> **"We travel together, passengers on a little spaceship, dependent on the vulnerable supplies of air and soil, preserved from annihilation only by the care, the work, and I will say, the love, we give our fragile craft."**
>
> **Adlai Stevenson**

2. Vocabulary Builders

DESIGN a game that teaches these "Ecology" words:

ADAPTATION	ENVIRONMENT
BACTERIA	ECOLOGY
COMMUNITY	BIOME
DECAY	FOOD CYCLE (food web)
HABITAT	PARASITE
SAPROPHYTE	PREDATOR
CONSUMER	PRODUCER
ORGANISM	POPULATION
CLIMAX CONDITION	GREEN PLANTS
OMNIVORE	HERBIVORE
SCAVENGER	CARNIVORE
POLLUTION	ACID RAIN

3. Ecosystems: Small Worlds

"Nature will bear the closest inspection. She invites us to lay our eye level with her smallest leaf, and take an insect view of its plain."

Henry David Thoreau

"So, naturalists observe, a flea
Hath smaller fleas that on him prey
And these have smaller still to bite 'm
And so proceed, ad infinitum."

Jonathon Swift

(Find out the meaning of ad infinitum.)

ECOSYSTEMS CAN BE VERY LARGE (as large as our whole planet) OR VERY SMALL (as small as a drop of water).

- With some friends, **CREATE** a small ecosystem of your own. You'll need a large jar or maybe a "leaker" from an aquarium store. Get some ideas from:

  Small Habitats by Lilo Hess
  Terrariums by John Hoke
  The Complete Book of Flowerpot Ecology by Anna B. and Elizabeth Gitter

— **OR** —

- There are tiny worlds all around us of which we are not even aware. **DISCOVER** some of them. **WRITE** a song or poem about these tiny creatures.

  See:

  What's Under a Rock? by Robert Gannon
  The Hidden World: Life Under a Rock by Laurence Pringle
  What We Find When We Look Under a Rock by Francis L. Behnke
  Life in a Drop of Water by George L. Schwartz
  A World in a Drop of Water by Alvin and Virginia Silverstein

4. Ecosystems: Cycles

MORE THAN ANYTHING ELSE, THE SCIENCE OF ECOLOGY TEACHES US ABOUT CYCLES.

We are very much a part of these never-ending "CIRCLES OF CHANGE" that flow around us.

DESIGN an illustrated Circle Book.

Cut pages of poster board, punch holes in the left side, and bind loosely with string so that the pages turn continuously with no beginning and no end.

On separate pages, show the stages of transformation for each of these:

the water cycle
the carbon cycle
the nitrogen cycle
the phosphorous cycle
the energy cycle

At what points are people seriously interfering with these cycles? **SHOW** these on the back of the appropriate pages.

5. Ecosystems

> "One man's ceiling is another man's floor."
> Paul Simon

RESEARCH THE 6 ZOOLOGICAL REALMS.

FIND OUT:

Why life-forms within each one have developed in a distinct way.

Why the boundaries are breaking down in modern times.

- On a map of the world **SHOW** these regions with some of their characteristic inhabitants.

— OR —

- **CREATE** a book for primary age children showing the plant creatures that make their homes in the different habitats . . . lakes, ponds, marshy wetlands, streams, deserts, estuaries, tundras, forests, shorelines, tidal pools, etc.

See: **Atlas of Wildlife** by Jacqueline Nayman

6. Ecosystems: Biomes

- **SURVEY** your classmates to determine who has traveled through or lived in different biomes. **GRAPH** your findings.

— OR —

- With some friends, **CREATE** mobiles showing typical animals and plant life of the various kinds of biomes for an "around the world" display.

— OR —

- Present a **DEBATE** on the statement . . . "Man will live in underwater habitats by the year 2050."

7. Ecosystems: Changes

DISCOVER the relationship between the **BALANCE OF NATURE** and **ECOLOGICAL SUCCESSION.**

What are the factors (physical, animal, or plant) that can bring about a change in an ecosystem?

CLASSIFY these change factors as either (1) slow and natural OR (2) sudden and traumatic.

In what ways do plants and animals react to the changes you listed above?

- **MAKE** a chart that displays your information.

— OR —

- **CREATE** an illustrated picture book showing either a slow change (e.g. from glacier to lake to forest) or a rapid one (e.g. recovery from a fire or volcano).

Good Resources: **Ecology Out of Joint: New Environments and Why They Happen**
by Lorus J. Milne and Margery Joan Greene
Birth of a Forest by Millicent E. Selsam
A Forest Is Reborn by James R. Newton
Birth of a Pond by John Hamberger
From Pond to Prairie by Laurence Pringle

> "Look abroad thro' Nature's range,
> Nature's mightly law is change."
> Robert Burns

LEARN how man has altered the ecosystems around him.

A good source is: **Man's Mark on the Land: The Changing Environment from Stone Age to the Age of Smog, Sewage, and Tar on Your Feet**
by Arthur S. Gregov

HYPOTHESIZE on future changes.

75

8. Ecosystems: Symbiosis

HAVE YOU EVER SEEN A TICK ON YOUR DOG? . . . MISTLETOE GROWING ON A TREE? . . . DO YOU KNOW ABOUT THE MOTH WHO SPENDS HIS LIFE IN A SLOTH'S FUR? . . .

Some plants and animals cannot live all by themselves. They need a partner. Partnerships can help provide food, cleaning services, or shelter. This is **SYMBIOSIS**.

Sometimes both partners are helped; sometimes only one is helped; sometimes one is harmed or even killed. Other kinds of partnerships are quite unintentional. (Have you ever found a burr hitchhiking on your sock?)

- **DISTINGUISH** between mutualism, commensalism, and parasitism.

  CREATE a book giving information about symbiosis.

  Include your observations of how humans may be somewhat symbiotic.

A starting place:

Natural Partnerships: The Story of Symbiosis by Dorothy Shuttlesworth
Plants and Insects Together by Dorothy Patent
Strange Partners by Sigmund A. Lavine
Unusual Partners: Symbiosis in the Living World by Alvin Silverstein

9. Ecosystems: Food Webs

CHOOSE an ecosystem.

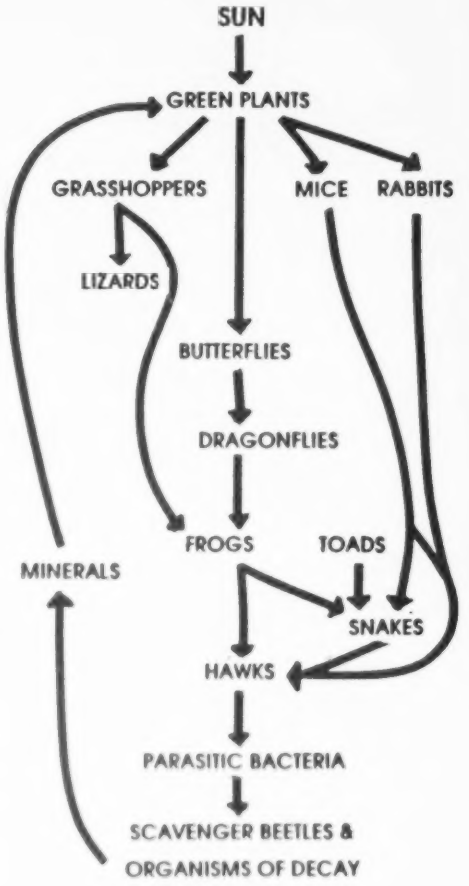
For instance, you might choose a desert ecosystem. Pass out small cards to about eight friends. Have them write the name of one plant or animal that can be found in a desert ecosystem on both sides of the card. Have each player turn up one side of the card.

Give one person a ball of string. The first person should hold onto the end of the string and pass the ball of string to someone with a card that has the name of an animal that would eat the plant or animal that is on the first person's card. The next person holds onto the string, but unravels the ball and passes it to another person who has an animal that would eat the second animal.

The object of the game is to pass the ball of string to every possible eater of each plant and animal. DON'T MISS ANY POSSIBILITY. (It gets very complicated, just like a food web in nature.)

Turn the cards over and try another food web. What might happen if one of the strands is broken? How many organisms are affected?

You will need: 1 ball of string; small cards for each player



SIMPLIFIED FOOD WEB

Note: The Sun acts on all of these directly or indirectly

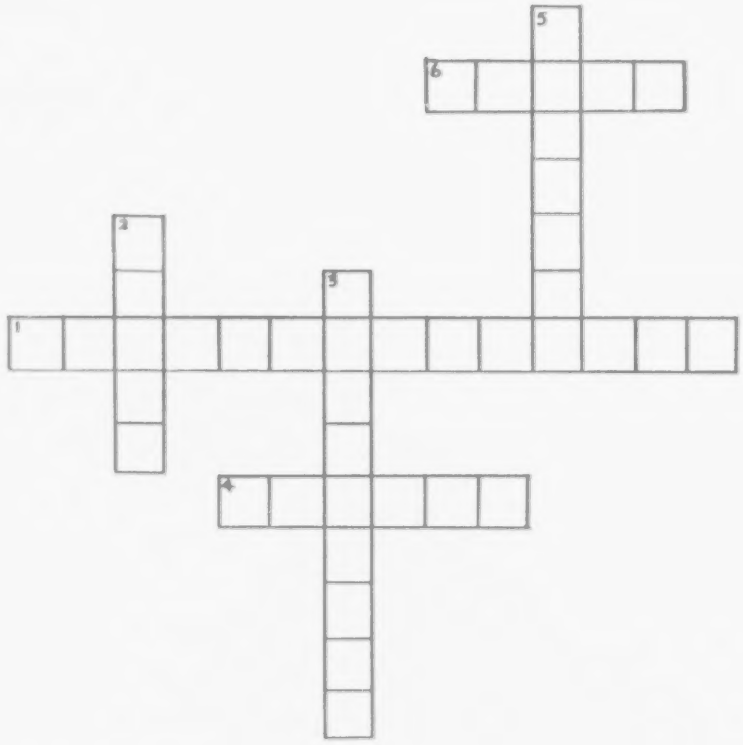
10. Ecology Crossword

ACROSS:

1. The process by which green plants create food energy, powered by the sun.
4. The kind of biotic community that tends to become stable for a long period of time.
6. The role an organism plays within its community; its "occupation".

DOWN:

2. A major land ecosystem named for its dominant kind of plant life, such as grassland or desert.
3. A close association between two unlike organisms that may benefit one or both partners.
5. The area where two ecosystems meet and blend together in a dynamic way; for example, the shore of a pond.



11. Endangered Species

CHOOSE an endangered animal. **RESEARCH** the animal thoroughly — use several sources.
WRITE a speech about this animal. Give it to a teacher to check . . .

Tape your speech and draw on a blank filmstrip to illustrate the tape.

Suggested animals:

Utah Prairie Dog
Kaibab Squirrel
Blue Whale
Timber Wolf
San Joaquin Kit Fox
Grizzly Bear
Southern Sea Otter
Florida Panther
Atlantic Salmon
Whooping Crane
Green Turtle
Hawaiian Monk Seal
Florida Sea Cow
Tule Elk
Key Deer
Bighorn Sheep
Musk Ox
Great White Heron
Eastern Brown Pelican
Gila Trout
American Alligator
Blue Pike
Black Toad
Prairie Chicken
Trumpeter Swan
Canadian Goose
Mexican Duck
California Condor
Southern Bald Eagle
Peregrine Falcon
American Crocodile

"God has lent us the earth for our life
It is a great entail
It belongs as much to those who follow us
as it does to us
And we have no right, by anything we may do
or neglect to do
To involve them in unnecessary penalties
Or to deprive them of the benefit
Which we have in our power to bequeath."
John Ruskin, 1819-1900

12. Adaptation

EXTREME ENVIRONMENTS

Some habitats present such extreme circumstances that people must be very resourceful to survive at all. Learn something about the lives of people who live in arctic, barren desert regions, undersea, or space environments.

- **COMPARE AND CONTRAST** how man has adapted to living in extreme environments.

— OR —

- **SELECT** five animals or birds and **CLASSIFY** their adaptive features according to:

STRUCTURAL (external) PHYSIOLOGICAL (internal) BEHAVIORAL

— OR —

- **FIND OUT** what "convergent adaptation" is.

  Choose three pairs of animals or plants that exemplify convergent development. **CREATE** a poster. With arrows and labels (or some other way) point out the related characteristics.

13. Treasure Hunt

"I thank You God for most this amazing
day: for the leaping greenly spirits of trees
and a blue true dream of sky: and for everything
which is natural which is infinite which is yes."

e.e. cummings

Work with three or four classmates to prepare an eco-treasure hunt for the rest of the class to play. The idea of the game is to be guided by notes directing you from place to place.

Example: Starting off, the first note might say: "I'm big and beautiful. I supply food for wildlife, put oxygen into the air, and sometimes a raccoon stays with me. My buds have little caps on them." (an oak tree)

When the class finds the oak they will find another message.

YOU AND YOUR GROUP must design the trails around the school grounds and write the notes.

HAVE FUN!

14. Pollution

MAKE an in-depth report on one of the following. **DESIGN** visuals to show your findings. Taking into consideration what you learn, make your own predictions.

a. Mercury pollution
b. Water pollution
c. Air pollution
d. Land pollution
e. Crop dusting and its effect on the environment
f. Pesticides
g. Erosion and land use relationships
h. Oil spills
i. Noise pollution
j. Transportation and environmental impact
k. Acid rain
l. Radiation

"Only in the last three years I was in office . . . .
did I see (conservation) as a whole piece. We'd erred
in thinking environment was simply a matter of managing
natural resources. What had to be managed was man himself."
Stewart Udall (in looking back over
his term as Secretary of the Interior)

15. Conservation: Wildlife

"Something will have gone out of us as a people if we ever let the remaining wilderness be destroyed . . . if we pollute the last clean air and dirty the last clean streams and push our paved roads through the last of the silence."

Wallace Stegner

— CHOOSE ONE —

- **FIND OUT** why the killing of coyotes is such a controversial topic.

  Recruit some friends and **ORGANIZE A DEBATE** between:
  - a "cattle rancher"
  - a "sheep rancher"
  - a "farmer"
  - a "conservationist"

  Ask each of them to propose a possible solution to their differences.

  Get information that is published by the group they represent. Your librarian will have their association's address . . . also articles can be found in the group's trade magazine. (Laurence Pringle's **The Controversial Coyote** can get you started.)

- The great whales that have roamed the oceans for millions of years may soon become extinct: one is killed every 14 minutes.

  PLAN a campaign aimed at protecting the whale. Include in your plan, your sequence of events, samples of posters and flyers, and a description of your target audience.

  See:
  Whale Watch by Ada and Frank Graham
  Sounds in the Sea by Francine Jacobs
  Whales and Other Sea Mammals (Time-Life) by Thomas Dozier

"If we sell you our land, you must keep it apart and sacred as a place where even the white man can go to taste the wind . . . ."

Chief Seattle, 1854

16. Taking a Stand

TAKE A STAND ON AN ISSUE CONCERNING THE ENVIRONMENT!

WRITE to a newspaper or an elected representative on an environmental issue. Write in business letter form in your best penmanship. Do your practice below. Have your practice checked and okayed before doing the "real" one. Names and addresses may be found in the library.

HEADING

INSIDE ADDRESS

GREETING

BODY

CLOSING

ENLIST others in your concern by **CREATING** a logo and slogan. Design bumper stickers, T-shirts and posters.

> "In defying nature, in destroying nature, in building an arrogantly selfish, man-centered, artificial world, I do not see how man can gain peace or freedom or joy."
>
> Marston Bates

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17. Ecology: Careers

ECOLOGY IS AN **INTERDISCIPLINARY** SCIENCE.

If an ecologist wanted to:	**He or she could ask the help of:**
analyze population growth trends	a. _____
study the relationship between weather and animal behavior	b. _____
clean up Lake Erie	c. _____
learn whether crowding increases stress	d. _____
study the effects of erosion on plants and animal life	e. _____
study the correspondence between plant and animal cycles	f. _____

Choose from: geologist, climatologist, phenologist, psychologist, limnologist, computer scientist.

18. Ecologists

Since the middle of the 19th century, when the harmful effects of the Industrial Revolution on America's previously unspoiled wilderness were becoming obvious, voices have been raised in protest. Some famous ecologists fought to stop the destruction. Their lives made a difference.

RESEARCH the diverse ecologists below and match them with their accomplishments. Some good sources are:

Pioneers of Ecology by Donald W. Cox
Heroes of Conservation by C.B. Squire
Guardians of Tomorrow by S. Carl Hirsch
Great American Naturalists by Ruth Allison Coates
They Loved the Land, Bennet Wayne (editor)

A. George Perkins Marsh (1801-1882)
B. Paul Ehrlich (1933 -)
C. John Muir (1838-1914)
D. Henry David Thoreau (1817-1862)
E. Rachel Carson (1907-1964)
F. Frederick Law Olmstead (1822-1903)
G. Jacques Yves Cousteau (1910 -)
H. John James Audubon (1785-1851)
I. Ian McHarg (1920 -)
J. Gifford Pinchot (1865-1945)
K. Theodore Roosevelt (1858-1919)
L. George Washington Carver (1860-1943)

(continued on next page)

ECOLOGISTS: (Continued)

____ 1. A biologist originally interested in the population control of animal species, this professor became convinced that the basic cause behind all environmental problems was too many people on an overcrowded planet — especially Americans whose lifestyle was so destructive to the ecosystem. Population control is stressed in the book _____.

____ 2. Though known for many other exploits, this lawyer and American leader also loved the outdoors and used his power to stop many abuses in the management of our natural resources and wildlife. He battled business interests and succeeded in setting aside millions of acres of land for national parks, game preserves, and monuments, including the Grand Canyon. Wrote _____

____ 3. Growing up on the seacoast gave this person an enduring fascination with the sea, which led first to a career as a Navy officer and later, after retirement, to a life of undersea exploration. He sounded a warning that pollution was already upsetting the oceans' fragile ecology, upon which all life ultimately depends. To teach the public he wrote _____ and has also made many _____

____ 4. This strong-minded forester became a politician and appeared just in time to stop the depletion of American woodlands, fighting hard for active government control of forests and natural resources to keep them productive for centuries to come. He stressed scientific forest management, helped found the Yale School of Forestry, and started the national conservation movement. Wrote _____.

____ 5. This shy, lonely boy grew up to be a lawyer, an unsuccessful businessman, and a diplomat, but is best known as a scholar whose classic book showed man as one part of a vast network of animals, plants, insects, soils, water, and weather. This book, which pointed out man's destructive effect on the harmonies of nature, became the foundation of the new science of ecology. He also helped found the Smithsonian Institution. Wrote _____.

____ 6. This quiet biologist, whose life was devoted to studying nature's intricate cycles and its web of creatures and plants, wrote fascinating books about the sea. In one final book, _____ wrote passionately about the dangers of chemical pesticides and other contaminants that could threaten all life on earth. Wrote _____.

____ 7. A farmer's son with an early love for inventing machines, this energetic and fervent naturalist hiked the wilderness areas of the West, fought to save them from commercial interests, and founded the famous Sierra Club. His efforts saved California's Yosemite Valley and the sequoia's. Wrote _____.

(continued on next page)

ECOLOGISTS (continued)

____ 8. With a deep love for the primitive, this artist sought out the undisturbed areas of America and painstakingly recorded birds and animals in their natural settings. He warned (correctly) that future generations would never see many of them again. Wrote and illustrated _____.

____ 9. With little faith in the institutions of society, this naturalist spent two years living in a hut in the woods near his home, observing the plants and creatures that lived there, describing them with respect and affection. Considered a misfit for refusing to join the ordinary work-a-day world, this writer and teacher pleaded for the preservation of the natural, untouched countryside. Wrote _____

____ 10. The flamboyant speeches and writings of this landscape architect and city planner have stimulated people to think about the ecology of city environments and have demonstrated that builders and designers do not have to destroy nature, but can work in harmony with it. Wrote _____

____ 11. Born as a slave, this artist and botanist dedicated his life to discovering scientific ways to restore fertility to soil worn out by too much cotton growing, bringing new prosperity to the South. He traveled in his demonstration wagon directly to the homes of poor farmers to teach them how to care for the land that he loved. At Tuskegee Institute, he wrote many _____.

____ 12. As a young man in New York City in the mid-19th century, this person longed for the clean air and water of the Connecticut countryside he had grown up in. After years of traveling, experimental farming, and writing, he was given a chance to take a neglected piece of land in the dirty city and turn it into an oasis — Central Park. He went on to design urban and campus parks across the country. The first person to call himself a "landscape architect", he was far ahead of his time in his concern for the city environment. Wrote _____.

"And the Lord God took man, and put him into the garden of Eden to dress it and keep it."
Genesis 2:15

---

19. Let's talk it over...

ORGANIZE a panel discussion or a "fireside chat" of one of the following groups:

Henry David Thoreau, Gifford Pinchot and John Muir

Rachel Carson and Paul Ehrlich

George Washington Carver and Gifford Pinchot

John Wesley Powell and John Muir

Members of the Sierra Club and Friends of the Earth

Members of Zero Population Growth and their opponents

Members of Greenpeace and Earth First and their opponents

COMPARE AND CONTRAST the qualities of these people.

20. Ecology: Careers

WHO WILL BE THE CARSONS, THE OLMSTEADS, THE CARVERS, AND THE COUSTEAUS OF THE NEXT GENERATION? MAYBE, THERE IS A PLACE FOR YOU.

- **INVESTIGATE** a career in environmental studies.

  Career:

  Educational Requirements:

  Duties:

  Salary:

  Opportunities:

  Why you chose this career:

Information sources:

Jobs That Save Our Environment: Exploring Careers by Melvin Berger
Career Education in the Environment: A Handbook, Olympus Research Corporation
Career Opportunities: Ecology, Conservation, and Environmental Control by Walter M. Arnold
Dictionary of Occupational Titles; Occupational Outlook Handbook;
Modern Vocational Trends Reference Handbook

21. Ecology Fair

ORGANIZE an Ecology Fair.

Show the results of your pollution research.

Present the tape and filmstrip of the endangered animals.

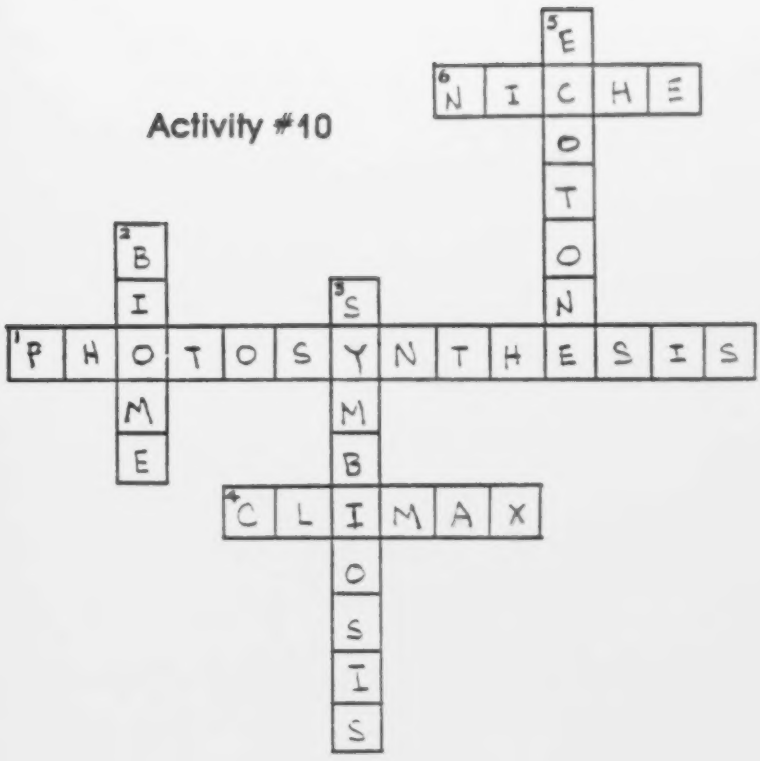
Categorize all the products (poems, books, banners, charts, etc.) in a meaningful way. Be sure to include copies of any letters.

Invite some interested persons.

Present skits, pantomimes, and songs that encourage concern in your favorite environmental issues.

ECOLOGY
ANSWER KEY

Activity #10



Activity #17

a. computer scientist
b. climatologist
c. limnologist
d. psychologist
e. geologist
f. phenologist

Activity #18

1. Paul Ehrlich; *The Population Bomb*
2. Theodore Roosevelt; *Life Histories of African Game Animals* and others
3. Jacques Yves Cousteau; *The Silent World, The Living Sea,* films for television
4. Gifford Pinchot; *The Training of a Forester; Breaking New Ground*
5. George Perkins Marsh; *Man and Nature: The Earth Modified by Human Action*
6. Rachel Carson; *The Sea Around Us; Edge of the Sea; Silent Spring*
7. John Muir; *A Thousand Mile Walk to the Gulf; The Mountains of California*
8. John James Audubon; *Birds of America*
9. Henry David Thoreau; *A Week on the Concord and Merrimack Rivers; Journal, Walden,* and others
10. Ian McHarg; *Design With Nature*
11. *George Washington Carver;* information bulletins for the public
12. Frederick Law Olmstead; *Walks and Talks of and American Farmer in England* and others

The Study of Ecology
Learning to Love Our Planet

BIBLIOGRAPHY

"Do not divert your love from visible things. But go on loving what is good, simple and ordinary, animals and things and flowers and keep the balance true."
Rainer Maria Rilke

ENERGY

Franklyn M. Branley	*Energy for the 21st Century*
Laurence Pringle	*Energy: Power for People*
Frank X. Ross	*The World of Power and Energy*

POPULATION

Issac Asimov	*Earth: Our Crowded Spaceship*
Robert M. McClung	*Mice, Moose, and Men: How Their Populations Rise and Fall*
Lila Perl	*The Global Food Shortage: Food Scarcity on Our Planet and What We Can Do About It*
Laurence Pringle	*One Earth, Many People: The Challenge of Human Population Growth*
Harris Stone and Stephen Collins	*Populations: Experiments in Ecology*

ECOLOGY AND THE CITY

Linda Allison (Sierra Club)	*The Wild Inside*
Margaret J. Anderson	*Exploring City Trees*
Anne Phelia Dowden	*Wild Green Things in the City*
Edward Gallob	*City Rocks, City Blocks, and the Moon*
Environmental Action Coalition	*It's Your Environment*
George Hennings and Dorothy Grant Hennings	*Keep Earth Clean, Blue, and Green: Environmental Activities for Young People*
Winifred and Cecil Lubell	*Birds in the City*
Julian May	*Wildlife in the City*
J.J. McCoy	*House Sparrows: Ragamuffins in the City*
Laurence Pringle	*Discovering Nature Indoors*
Mollie Rights	*Beastly Neighbors*
Glen Rounds	*Wildlife at Your Doorstep*
Helen Ross Russell	*City Critters*
Paul Swatek	*The User's Guide to the Protection of the Environment*
Robert H. Wright	*What Good is a Weed? Ecology in Action*

The Study of Ecology
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GENERAL BIBLIOGRAPHY

For Young Readers:

Gabel, Margaret — *Sparrows Don't Drop Candy Wrappers* (1971)
Leaf, Munro — *Who Cares? I Do.* (1971)
Miles, Betty — *Save the Earth! An Ecology Handbook for Kids* (1974)
Milgrom, Harry — *ABC of Ecology* (1972)
Podendorf, Illa — *Every Day is Earth Day* (1971)

For More Adult Readers:

Aylesworth, Thomas G. — *This Vital Air; This Vital Water: Man's Environmental Crises* (1968)
Bates, Marston — *The Forest and the Sea* (1965)
Behnke, Frances L. — *The Changing World of Living Things* (1972)
British Museum — *Nature at Work: Understanding Ecology* (1978)
Environmental Action Coalition — *It's Your Environment* (1976)
Gregor, Arthur S. — *Man's Mark on the Land: The Changing Environment from Stone Age to the Age of Smog, Sewage, and Tar on Your Feet* (1974)
Hoke, John — *Ecology: Man's Effects on His Environment and Its Mechanisms* (1971)
Hirsch, S. Carl — *The Living Community: A Venture into Ecology* (1966)
Hungerford, Harold R. — *Ecology: The Circle of Life* (1971)
Jennings, Gary — *The Shrinking Outdoors* (1972)
Nobile, Philip and Deedy, John — *The Complete Ecology Fact Book* (1972)
Pringle, Laurence — *Ecology: Science of Survival* (1971)
Pringle, Laurence — *The Only Earth We Have* (1969)
Roth, Charles E. — *The Most Dangerous Animal in the World* (1971)
Shuttlesworth, Dorothy — *Clean Air - Sparkling Water* (1968)

ENVIRONMENTAL ORGANIZATIONS

Write for Classroom and Public Information, Charts and Filmstrips

American Forestry Association
1319 18th St., N.W.
Washington, D.C. 20036

American Museum of Natural History
Central Park West at 79th Street
New York NY 10024

American Society for Environmental Education
P.O. Box 800
Hanover, NH 03755

Association for Conservation Information
P.O. Box 40747
Nashville, TN 37204

Audubon Naturalist Society of
Central Atlantic States
8940 Jones Mill Road
Chevy Chase, MD 20815

The Book Nest
Richardson Bay Wildlife Sanctuary
376 Greenwood Beach Road
Tiburon, CA 94920

Center for Action on Endangered Species
175 West Main Street
Ayer, MA 01432

Center for Environmental Education
624 9th Street, NW
Washington, D.C. 20001

Center for Renewable Resources
1001 Connecticut Ave., NW, Suite 510
Washington, D.C. 20009

Center for Science in the Public Interest
1755 S Street, NW
Washington, D.C. 20009

Children of the Green Earth
Star Rt., Box 182
Umpqua, OR 97486

Citizens for Conservation
Hannan House
4750 Woodward Avenue
Detroit, MI 48201

Council on Environmental Quality
722 Jackson Place, NW
Washington, D.C. 20006

The Cousteau Society
777 3rd Avenue
New York NY 10017

Defenders of Wildlife
1244 19th St., NW
Washington, D.C. 20006

East Bay Municipal Utility District
Public Information Office
2130 Adeline St.
Oakland, CA 94623

Ecology Center
2701 College Avenue
Berkeley, CA 94705

Environmental Action Coalition
417 Lafayette St.
New York NY 10003

Friends of the Earth Foundation
1045 Sansome St.
San Francisco, CA 94111

Greenpeace, U.S.A.
2007 R St., NW
Washington, D.C. 20009

Massachusetts Audubon Society
Lincoln, MA 01773

National Association for
Environmental Education
P.O. Box 400
Troy, OH 45373

National Audubon Society
Education Division
950 Third Ave.
New York, NY 10022

National Parks and Conservation Ass'n
1701 18th St., NW
Washington, D.C. 20006

National Wildlife Federation
1412 16th St., NW
Washington, D.C. 20036

Nature Conservancy
1800 N. Kent, Suite 800
Arlington, VA 22209
(also Isaac Walton League, same address)

ENVIRONMENTAL ORGANIZATIONS (Continued)

New York State Department of
Environmental Conservation
50 Wolf Road
Albany, NY 12233-0001

Project Jonah
Box 476
Bolinas, CA 94924

Scientists' Institute for Public Information
355 Lexington Avenue
New York, NY 10017

Sierra Club
530 Bush St.
San Francisco, CA 94108

Zero Population Growth
1346 Connecticut Ave., NW
Washington, D.C. 20036

Also, see your librarian for organizations for protecting specific species: e.g., wolves, whales, prairie chickens, peregrine falcons, condors, etc.

MAGAZINES

Young people:

Owl
Eco-News (Environmental Action Coalition newsletter)
National Geographic World (National Geographic)
Junior Natural History Magazine (American Museum of Natural History)
Young Naturalist (Massachusetts Audubon Society)
Ranger Rick (National Wildlife Federation)

Adult:

Audubon (National Audubon Society)
Defenders Magazine (Defenders of Wildlife)
Environment (Scientists Institute for Public Information)
The Conservationist (New York State Dept. of Environmental Conservation)
Natural History (American Museum of Natural History)
Not Man Apart (newsletter - Friends of the Earth)
Sierraecology (Sierra Club newsletter for teachers)

and many others...

Exploring The Arts

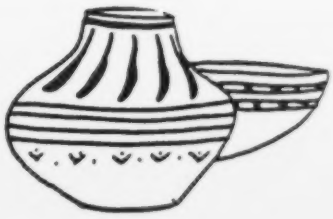
an opportunity to integrate art experiences within an academic content area.

by
Stephany Grassinger

While each component . . . the self-directed learning unit and Exploring the Arts . . . is a complete and valid learning experience in itself, together they provide a more comprehensive and lasting educational experience for the learner.

The Study of Ecology
ART SUPPLEMENT

PRIMITIVE POTTERY



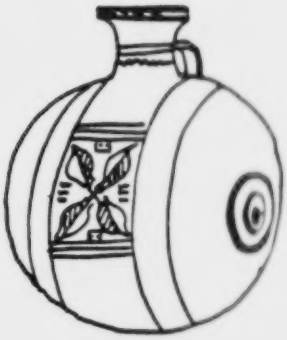
Years ago, Indians produced their own pottery to use for cooking and storing foods and water. Today, beautiful Indian pottery is created for decorative and artistic purposes.

The Pueblo Indians from New Mexico are famous for their black pottery. This pottery is made from clays dug from the ground fired in pits with recycled organic materials like animal dung, woods and leaves.

READ about the **black pottery** of the Pueblo Indian, Maria Martinez.

SEARCH your community for a contemporary artist who fires pottery using a primitive technique.

INVITE the artist to your classroom to talk about the process. Encourage the artist to bring samples, slides, or photos of his/her work.



CREATE a clay pot using the **coil technique**. Check your library for books with directions about coil pots.

INVESTIGATE the process of **primitive firing**.

The primitive firing of clay pots is very inexpensive because Mother Nature supplies all of the materials. After you have gathered all of the information, discuss the process with your teacher. If possible, primitive fire your pottery.

Supplies:

1. shovels
2. picks
3. rakes
4. work gloves (optional, but nice)
5. matches (unless you want to rub two sticks together!)

ESKIMO SCULPTURE

The Eskimos create beautiful art that clearly reflects the extreme conditions of this environment. The simple tasks of eating, keeping warm and having shelter occupy much of their time. As a result, seals, bears, fish, and Eskimo hunters are common subjects for their art.

INVESTIGATE your library for books with examples of Eskimo art. Notice the simple, smooth shapes the Eskimos use to express their ideas.

With some friends, **MAKE** an illustrated list of the most common subjects of Eskimo art. Display the list in your classroom.

CREATE a sculpture out of papier-mache that expresses an idea about your **own environment**.

FIRST . . .
Draw a sketch of your idea with a pencil or make a small model of your idea with modeling clay.

TO BEGIN . . .
Use newspaper to build the form of your sculpture. Use masking tape to hold the newspaper in shape.

Prepare the papier-mache in a bowl by mixing flour or wheat paste with water to a creamy consistency. (Check out a book from the library if you want more detailed directions for mixing papier-mache.)

Tear some newspaper into 1/2" strips. Dip the newspaper strips into the papier-mache mixture to get them wet. Wipe off the excess with your fingers. Lay the strips on your form, overlapping them a little each time. Cover the form with two or three layers of papier-mache strips.

Let the sculpture dry for 48 hours.

IT'S TIME TO DECORATE.

Paint the sculpture with tempera or acrylic paint. Let the paint dry completely. Add any details with recycled bits of fabric, beads, yarn, etc.

RUBBINGS FROM NATURE

COLLECT man-made and natural objects from the environment.

CLASSIFY the objects and divide them into two groups, natural and man-made. For example:

Natural:	**Man-Made:**
leaves	corduroy cloth
bark	ceramic tiles
insect wings	sandpaper
fish skeleton	corrugated cardboard
seashells	window screen

CREATE two designs by taking rubbings from the objects you collect in each group.

TO BEGIN A RUBBING . . .

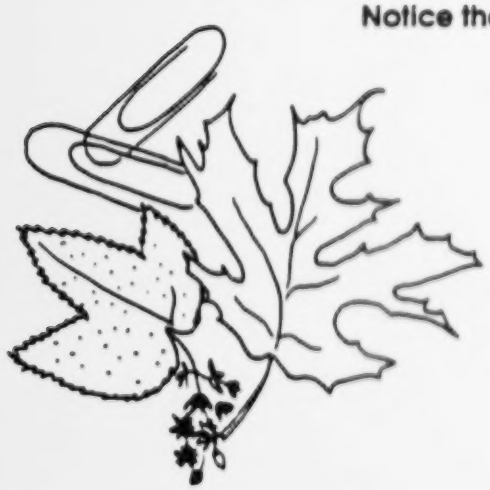
You take a rubbing by laying a sheet of paper over the object you wish to use. With a crayon, color gently over the object. An impression will appear on the paper. The outline and texture of the object will be visible.

BE CREATIVE. Use a variety of colors for your rubbing. Overlap the rubbing to create **variety** in your composition.

DISPLAY your work. Group the designs made with natural objects together in one space. Then display the rubbings made from man-made objects together.

COMPARE AND CONTRAST the visual qualities of designs.

Notice the:
colors
shapes
texture
overlapping
detail
arrangement



LANDSCAPE PAINTING

Landscape is a favorite subject for artists to paint. Some artist spaint their landscapes realistically just as they look in nature. Other artists "abstract" their landscapes. Abstract painters paint the land in a new and unique way with colors not usually found in nature.

Impressionist painter, Claude Monet, painted the sunlight as it sparkled on the landscape. Belgian artist Vincent van Gogh tried to express his feelings through his landscapes with short, rapid brush strokes and intense colors.

CHECK your library for art books with reproductions of landscape paintings. Some artists to look for are:

Claude Monet
Vincent van Gogh
Paul Cezanne
Jean Baptiste Camille Corot
Thomas Cole

COMPARE AND CONTRAST different styles of landscape painting. Discuss your observations with other members of your class.

DISCOVER these characteristics:
color
texture
space/distance
movement/direction
detail
realistic or abstract style

CREATE your own landscape painting that describes a particular environment; for example, a desert, mountain range, forest, or seashore. Use watercolors, tempera, or acrylic paints.

DISPLAY your painting for others to enjoy.

— OR —

DESIGN an underwater environment. Create a society of new sea animals. Imagine that this environment evolved after many centures of erosion and change.

Use crayons, oil pastels or paints to color your environment.

MASK MAKING

CREATE a mask from "all recycled" materials. Use cardboard or fabric for the foundation of the mask. Add other materials for decoration with glue or by sewing.

Some suggestions for materials are:

cardboard
boxes
plastic bottles and caps
packing materials
egg cartons
paper rolls
beads, trims, fabrics

FINISHING TOUCHES:
If your mask is made of materials that can be painted, use a spray paint or a brush to paint it all one color. (Using only one color will create a harmonious unity among the many materials.) Allow the materials themselves to provide the visual interest.

ORGANIZE a mask parade or some other way to display your work for the rest of the school.

HANDMADE PAPERS

Handmade papers can be created from recycled papers, cloth and fibrous plants.

RESEARCH the possibility of making handmade papers in your classroom.

VISIT your school and community libraries and check out books on handmade papermaking. **Outline** the process for your teacher. **Organize** a group to collect the necessary supplies. **Design** a system of working so that everyone in the class can produce some paper.

HINT:

An ordinary kitchen blender, a piece of window screen, some scrap wood, a bucket and a sponge are some of the simple supplies you will need to make paper.

The art of papermaking is being revived all over the United States. **INVESTIGATE** your local community of artists for a papermaker.

INVITE a papermaker to your classroom. Ask him/her to demonstrate some simple techniques to use in school.

For your information, two very good books on papermaking are:

Paper-Making by Jules Heller
Watson-Guptill Publications

The Art of Papermaking
by Bernard Toale
Davis Publications